

## Advanced Thermoset Nanocomposites, Phase I

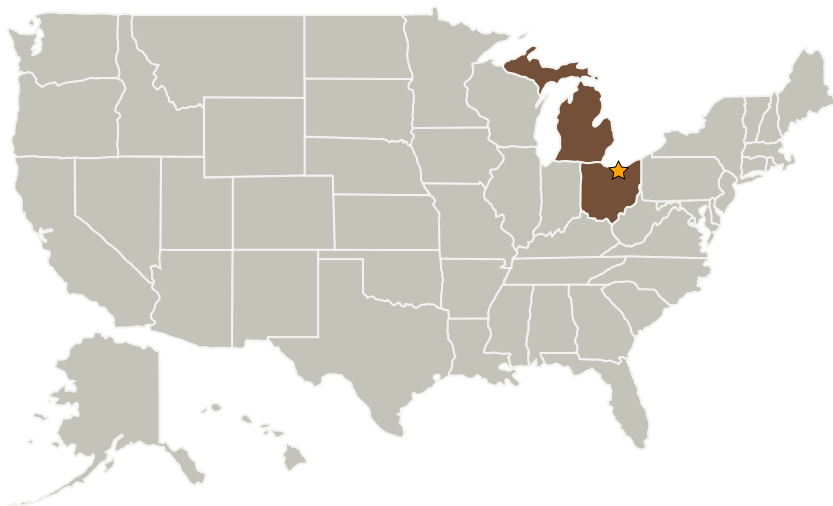
Completed Technology Project (2009 - 2009)



## Project Introduction

Low-cost, environmentally compatible synthesis methods are used to prepare silicate nanoparticles with surface areas, surface polarity and hierarchical lamellar and mesoporous structures ideally suited as barrier and reinforcing agents for epoxy and polyimide thermoset polymers for use in next generation air transport systems (NGATS) and related aerospace vehicles. Unlike organoclays, which require temperature-sensitive organic modification for dispersion in polymer matrices, the new nanoparticles require no organic surface modification to achieve compatibility in the polymer matrix. Thus, thermoset nano-composites made from Claytec's purely inorganic nanoparticles exhibit superior thermal and oxidative stability, in addition to improved strength, stiffness and toughness. The technical objective of the proposal is to provide silicate nanoparticles that will improve substantially the thermal and oxidative stability properties, as well as the mechanical properties, of epoxy and polyimide polymers without the need for organic surface modifiers to achieve particle dispersion in the polymer matrix. The specific tasks associated with the proposed research project are (i) the synthesis and characterization of lamellar and mesoporous silicate nanoparticle suitable as barrier and reinforcing agents, respectively (ii) the preparation of representative epoxy and polyimide thermoset nanocomposites containing well-dispersed lamellar and mesoporous nanoparticles and (iii) the characterization of the nanocomposites with regard to oxygen permeability, oxidative stability, and tensile and impact properties.

## Primary U.S. Work Locations and Key Partners

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Organizational  
Responsibility**Responsible Mission  
Directorate:**Space Technology Mission  
Directorate (STMD)**Lead Center / Facility:**

Glenn Research Center (GRC)

**Responsible Program:**Small Business Innovation  
Research/Small Business Tech  
Transfer

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Claytec, Inc.	Supporting Organization	Industry	East Lansing, Michigan

Primary U.S. Work Locations	
Michigan	Ohio

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.1 Materials
    - └ TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines